

SUBSTRATE TREATMENT APPARATUS

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Abstract

PROBLEM TO BE SOLVED: To provide a small substrate treatment apparatus with uniformity in treatment, regardless of the positions in a batch-treatment container, and no damage due to the rotation or in-face uniformity in treatment of a large-size wafer in a single wafer treatment container, while strains such as watermarks or damages in rotation are prevented.

SOLUTION: A substrate treatment apparatus includes a substrate treatment container 2, made up of an upper cover 5 for opening and closing tightly and a container member 23, and a substrate holding member 4 for holding a wafer 3 in the container member 23. In a controlling means 7, valve members 71 to 77, and 79, driving members 22 and 42, and a reducing pressure pump 78 are controlled by a control unit 80 to feed and/or drain a treatment solution and/or gas in the container member 23. In this way a chemical treatment, a washing treatment, and a drying treatment are sequentially carried out. A wafer 3 is immersed in the small sealed substrate treatment container 2, and the face of the wafer 3 is processed in various kinds of treatments.

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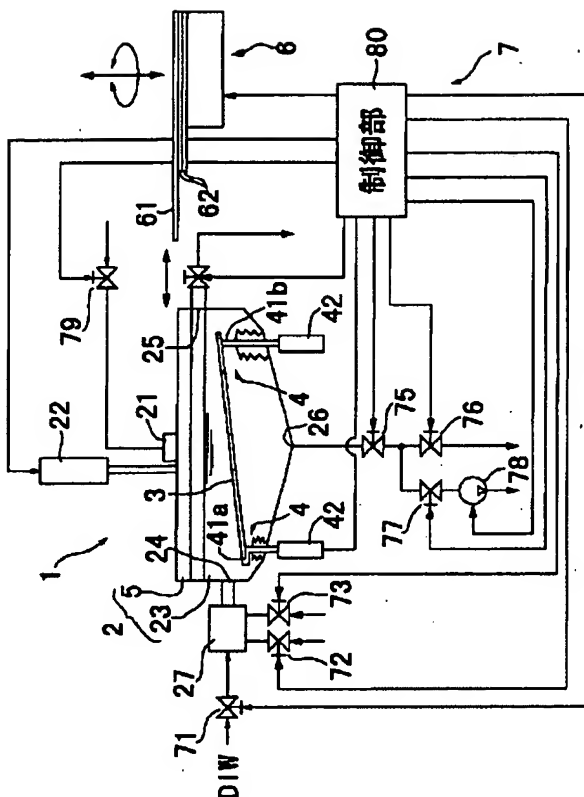
Summary.

(57) [Abstract]

[Technical problem] While suppressing generating of the watermark (silverfish) which miniaturized the size of equipment itself while canceling the position dependency in a tub of the processing homogeneity conventionally produced with the equipment for batch processing, and had been conventionally produced with the substrate processor for sheet processing and holding the homogeneity on the front face of a substrate, it is made to correspond to enlargement of substrate size without damage by rotation.

[Means for Solution] the top cover 5 in which opening or sealing of the interior is free, and a tub -- the substrate processing tub 2 which consists of a member 23 77, 79, driving member 22 and 42, and the reduced pressure pump 78 are controlled by the control section 80. this tub -- the substrate attaching part 4 which can hold a wafer 3 within a member 23, and a bulb -- member 71- a tub -- processing liquid or/, and a raw gas by supply or/, and discharging in a member 23 It has the control means 7 controlled to perform dryness processing to medical fluid processing and a rinsing processing pan one by one, and one wafer 3 is immersed into the processing liquid in the sealed small substrate processing tub 2, and various processings are performed to the front face.

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CLAIMS

[Claim(s)]

[Claim 1] the substrate processor which can process a substrate front face where a substrate is held inside -- setting -- the outline member in which opening or sealing of the interior is free, and this outline -- a member -- the substrate attaching part which can hold a substrate inside, and the aforementioned outline -- a member -- the substrate processor characterized by having supply or/, and the control means

controlled to discharge for processing liquid or/, and a raw gas inside

[Claim 2] The substrate processor which can process a substrate front face where [which is characterized by providing the following] a substrate is held inside. the outline in which opening or sealing of the interior is free -- a member this outline -- a member -- it arranges inside -- having -- the depot which can store processing liquid It is the substrate attaching part which can be held in a longitudinal direction about a substrate within this depot. supply of the processing liquid into the effluent tub which receives the processing liquid overflowed from the aforementioned depot, and the aforementioned depot, and the aforementioned outline -- a member -- the control means which control the effluent out of supply of the raw gas inside, the aforementioned depot, or/and an effluent tub, or exhaust air

[Claim 3] The aforementioned substrate attaching part is level or a substrate processor according to claim 1 or 2 characterized by having the supporter material supported with an inclination posture, and the driving member which moves this supporter material to the vertical position the inside of processing liquid, and besides processing liquid about the aforementioned substrate.

[Claim 4] The aforementioned supporter material is a substrate processor given in any of the claim 3 characterized by having made the substrate incline and considering as the composition which can be supported so that a processing liquid supply side may become low they are.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the substrate processor which supplies processing liquid, a raw gas, etc. to the processed substrate (only henceforth a substrate) of the shape of sheet metal, such as a semiconductor wafer and a glass substrate for liquid crystal display panels, and performs

predetermined surface treatment to a substrate.

[0002]

[Description of the Prior Art] Conventionally, the substrate processor which forms a thin film on substrates, such as a semiconductor wafer and a glass substrate for liquid crystal displays, or carries out washing etching of the substrate is offered as one of the equipment for manufacturing a semiconductor device and a liquid crystal display. In this substrate processor, the processing section which performs the processing section which forms a thin film, and substrate washing being prepared, and conveying a processed substrate among these processing sections by the substrate transport device, processing liquid is supplied to a substrate in each processing section, and surface treatment of a substrate is performed.

[0003] For example, in the case of the substrate processor of the multi-tub type for batch processing, in two or more processing tubs, two or more substrates are simultaneously conveyed by the substrate transport device, and pure water washing processing is performed to a medical fluid processing pan because you make it immersed in processing liquid, and finally, the spin dryer, the IPA vapor dryer, etc. are performing dryness processing one by one.

[0004] Moreover, in the case of the substrate processor of the single tub type for batch processing, one tub is performing pure water washing processing to the medical fluid processing pan one by one by conveying two or more substrates by the substrate transport device simultaneously, and making them immersed in processing liquid.

[0005] On the other hand, in the case of the substrate processor for sheet processing, it conveys one substrate at a time by the substrate transport device, for example, etching and washing processing are performed by the spray and rotation processing, after that, it rotation for the first time in cuts, or the air knife is performing dryness processing.

[0006]

[Problem(s) to be Solved by the Invention] however, in the substrate processor of the multi-tub type for the above-mentioned conventional batch processing, and a single tub type The substrate located in the middle when making two or more substrates arranged so that a substrate side might counter mutually immersed in the processing liquid currently overflowed, for example, performing etching, washing processing, etc., By the substrate located in ends, such as a near-side side or a back side, since the flows of processing liquid differed, variation arose, for example in etching, washing processing, etc., and it had the problem that the position dependency in a tub of processing homogeneity occurred. This homogeneous position dependency in a tub appears so notably that the wafer as a substrate becomes a diameter of macrostomia as it was called the aperture of 300mm. Moreover, in order to process two or more substrates simultaneously, in the substrate processor for batch processing, the size of equipment itself also became large with the size of the tub, and it had the problem

that a lot of processing liquid, such as a medical fluid and pure water, was needed. Furthermore, a big tub is independently needed also about reduced pressure drying in this case.

[0007] Moreover, in the substrate processor for the above-mentioned conventional sheet processing, in order to convey one substrate at a time, for example, to perform spray rotation washing processing etc., when the front face of a substrate was exposed to the atmosphere with moisture during various processings of a substrate, it had the problem that the homogeneity on front faces of a substrate, such as generating of the watermark (silverfish) resulting from growth of a surface natural oxidation film etc. and generating of the particle according to it further, was spoiled. It is the factor which this natural oxidation film has unstable resistance, for example, reduces the yield in manufacture of a semiconductor device etc. Moreover, in the substrate processor for sheet processing, the load of the substrate by rotation itself and the mechanism section became large, and it had the problem that substrate size was not greatly made from a viewpoint of those injury prevention, so that substrate sizes, such as aperture of a wafer, became large, in order to rotate one substrate at a time and to perform various processings.

[0008] this invention solves the above-mentioned conventional problem, and while canceling the position dependency in a tub of the etch uniformity conventionally produced with the equipment for batch processing, the size of equipment itself is miniaturized. Moreover, while suppressing generating of the watermark (silverfish) conventionally produced with the substrate processor for sheet processing and holding the homogeneity on the front face of a substrate, it aims at offering the substrate processor which can be made to correspond to enlargement of substrate size easily without the injury by rotation.

[0009]

[Means for Solving the Problem] the substrate processor with which the substrate processor of this invention can process a substrate front face where a substrate is held inside -- setting -- the outline member in which opening or sealing of the interior is free, and this outline -- a member -- the substrate attaching part which can hold a substrate inside, and an outline -- a member -- it is characterized by having supply or/, and the control means controlled to discharge for processing liquid or/, and a raw gas inside

[0010] the outline sealed by this composition -- a member, since various processings are performed to a substrate front face in the state where one substrate was made immersed into processing liquid inside While the homogeneous position dependency in a tub of the processing conventionally produced with the equipment for batch processing is canceled Generating of the watermark (silverfish) conventionally produced with the substrate processor for sheet processing is suppressed, the homogeneity on the front face of a substrate is held, and it becomes possible to make it correspond to enlargement of substrate size without the injury by rotation like

before. Moreover, since an outline member is [containing one substrate] only small, while attaining miniaturization and ** space-ization, it becomes still more possible ***** liquefaction and to also attain shortening of the processing time, and low-cost-ization is attained.

[0011] Moreover, the substrate processor of this invention is set to the substrate processor which can process a substrate front face where a substrate is held inside. It is arranged inside the outline member in which opening or sealing of the interior is free, and this outline -- a member -- with the depot which can store processing liquid. The effluent tub which receives the processing liquid which overflowed the substrate from the depot within this depot with the substrate attaching part which can be held in a longitudinal direction, supply of the processing liquid into a depot, and an outline -- a member -- it is characterized by having the control means which control the effluent out of supply of the raw gas inside, a depot, or/and an effluent tub, or exhaust air.

[0012] this composition -- the above-mentioned operation -- in addition, an outline -- a member -- inside. Since the depot which holds a substrate, and the effluent tub which receives the processing liquid overflowed from this depot are prepared while storing processing liquid. In pure water washing processing etc., the medical fluid which adhered to the substrate at the time of medical fluid processing, and the matter (particle) generated by medical fluid processing for example, with pure water an effluent tub -- minding -- an outline -- a member -- while becoming possible to begin to pass smoothly outside and suppressing the bad influence to a substrate front face further, it is suppressed further, and growth of a natural oxidation film etc. is suppressed further and the contact to the atmosphere on the front face of a substrate also becomes maintainable [a substrate front face / the further homogeneity]

[0013] Furthermore, the substrate attaching part in the substrate processor of this invention is preferably characterized for a substrate by level or having the supporter material supported with an inclination posture, and the driving member which moves this supporter material to the vertical position the inside of processing liquid, and besides processing liquid.

[0014] Since it can move to the lower position in processing liquid, and the upper position besides processing liquid freely by driving member after the substrate attaching part has held the substrate in the longitudinal direction by supporter material by this composition, a substrate is made to flood with processing liquid in the lower position, predetermined processing is performed, and it succeeds in delivery of a substrate easily in an upper position.

[0015] Furthermore, preferably, the supporter material in the substrate processor of this invention is characterized by having made the substrate incline and considering as the composition which can be supported so that a processing liquid supply side may become low.

[0016] Since a substrate inclines in a longitudinal direction and is supported by this composition at it so that a processing liquid supply side may become low, although it makes a lateral substrate immersed in processing liquid or takes out from the inside of processing liquid While suppressing the liquid remainder on bending and the substrate front face of a substrate and making a liquid piece good at this time, the position dependency in a tub of the processing homogeneity conventionally produced with the equipment for batch processing because the supplied processing liquid makes it easy to flow in the whole substrate front face may be canceled more certainly.

[0017]

[Embodiments of the Invention] Although the operation gestalt of the substrate processor concerning this invention is hereafter explained with reference to a drawing, this invention is not limited to the operation gestalt shown below.

[0018] Drawing 1 is the ** type view showing the outline composition of the substrate processor of 1 operation gestalt of this invention.

[0019] In drawing 1, while the substrate processor 1 holds the wafer 3 as a substrate within the substrate processing tub 2 as an outline member in which opening or sealing of the interior is free, and this substrate processing tub 2 The substrate attachment component [in the state where the wafer 3 was held] 4 which can vertical move a wafer 3, While controlling the carrier robots 6 which carry out the feeding and discarding of the wafer 3 to the substrate processing tub 2 at the time of opening of the top cover 5 of this substrate processing tub 2, and these substrate attachment components 4 and carrier robots 6 and making a wafer 3 transfer It has the control means 7 which control processing liquid or/, and a raw gas in the substrate processing tub 2 to perform dryness processing to various kinds of medical fluid processings and a rinsing processing pan one by one on the front face of a wafer 3 in supply or/, and the sealing state that discharged and held the wafer 3 in the interior.

[0020] The raw-gas feed hopper 21 to which this substrate processing tub 2 can supply nitrogen gas and an IPA (isopropyl alcohol) steam freely, The driving member 22 which a point is attached [driving member] in the outer wall proper place of the top cover 5 by which this raw-gas feed hopper 21 was arranged in the center section, and this top cover 5, and carries out vertical movement of the top cover 5, such as a solenoid for opening and closing, and a cylinder, While the interior can open freely by carrying out vertical movement of the top cover 5 by this driving member 22 the sealant which is not illustrated -- a top cover 5 -- putting -- the tub which can be sealed freely -- with a member 23 this tub -- it being arranged by the side-attachment-wall lower part of a member 23, and with the processing liquid feed hopper 24 which supplies processing liquid, such as a medical fluid and pure water, in a tub the tub in which this processing liquid feed hopper 24 was arranged -- with the overflow effluent mouth 25 which is arranged in the side-attachment-wall upper part of an opposite side, is made to overflow the processing liquid supplied in the tub from

the processing liquid feed hopper 24, and carries out an effluent to the side attachment wall of a member 23 a tub -- it arranges in the bottom wall center section of the member 23 -- having -- **** -- a tub -- or it carries out the rapid effluent of the processing liquid in a member 23 -- or a tub -- it has the exhaust port 26 which exhausts and decompresses the gas in a member 23 Thus, as for the substrate processing tub 2, the wafer 3 as a substrate is the small sealing chamber of the DIP formula in which one-sheet hold in a longitudinal direction is possible, with the miniaturization of equipment size, early, medical fluid substitution can be performed early and reduced pressure attainment can also raise [substitution] a throughput now.

[0021] Moreover, as for the substrate attachment component 4, the processing liquid feed-hopper 24 side becomes low. The supporter material 41a and 41b which supports the edge of a wafer 2 while two or more support (two places are supported with this operation gestalt) receives the edge portion of the rear face of a wafer 3 from a lower part in the state where the wafer 3 was made to incline in a longitudinal direction so that the overflow effluent mouth 25 side may become high, Each point is attached in these supporter material 41a and 41b, respectively, and it has each driving member 42, such as a cylinder which carries out vertical movement of these supporter material 41a and 41b, respectively between the lower position in processing liquid, and the upper position on processing liquid. This supporter material 41a is supported by the line contact along with the edge portion by the side of the 1 subordinate of a wafer 3, supporter material 41b is supporting the upper edge portion by the point contact, and these supporter material 41a and 41b consists of only rear-face edge contact of a wafer 3 so that the portion which cannot be washed to the front-face side of a wafer 3 may not occur.

[0022] Moreover, making a longitudinal direction incline and holding one wafer 3 in this way The processing liquid which holds so that the front face of a wafer 3 may be suitable in accordance with the flow of processing liquid, and is supplied from the processing liquid feed hopper 24 By receiving by the whole front-face side of a wafer 2, making it overflow smoothly from the overflow effluent mouth 25, and carrying out an effluent two or more sheets conventional DIP formulas, while making it the position dependency in a tub of etch uniformity [like] not occur When moving a wafer 3 to the upper position on processing liquid, it has good composition of a liquid piece so that a load may not be applied as much as possible to a wafer 3, but a wafer 3 may bend and processing liquid may not collect. a relation with the processing volume made to store although the degree of tilt angle of the wafer 2 in this case needs to select the good angle of the liquid piece of a grade to which the processing liquid of the front face of a wafer 3 flows and falls from the front face of a wafer 3 easily, without substrates, such as a wafer 2, bending -- a tub -- a member 23 has the shallower good one

[0023] moreover, a tub -- in the arrangement position of the substrate attachment

component 4 of the bottom wall portion of a member 23 A part for the center section of a bellows-like member is arranged free [vertical movement] so that it may be in a sealing state about the inside of a member 23. the bellows-like member which consists of elastic bodies, such as a fluoro-resin, — a tub — Both the driving member 42 constitutes between the lower position in processing liquid, and the upper positions on processing liquid for the wafer 3 from the inclination posture respectively free [vertical movement] with the supporter material 41a and 41b. Although a wafer 3 is further made into a horizontal position from the upper position on this processing liquid, and delivery by the carrier robot 6 consists of these operation gestalten at the time of the feeding and discarding of a wafer 3 so that easily, it is needless to say that delivery by the carrier robot 6 can be performed with the inclination posture of the wafer 3 of the upper position on processing liquid.

[0024] furthermore, the hand whose carrier robot 6 supports a wafer 3 from a lower part — with a member 61 this hand — up to the wafer 3 bottom which was connected with the point of a member 61 at the end section of an opposite side, and was held by the substrate attachment component 4 in the upper position — a hand — a member 61 being lengthened or the arm its drawn in from the wafer 3 bottom held by the substrate attachment component 4 in the upper position to the predetermined position of drawing 1 — a member 62 — having — **** — these hands — a member 61 and an arm — both the members 62 by making it move upward A receipt is possible in the substrate attachment component 4 to the wafer 3 by laying on a member 61 and raising. the wafer 3 held by the substrate attachment component 4 — a hand — moreover, a hand — the state where the wafer 3 was laid on the member 61 — a hand — a member 61 and an arm, by moving a member 62 downward with a wafer 3, the wafer 3 could be made to be able to lay on the substrate attachment component 4, the wafer 3 could be supplied on the substrate attachment component 4, and it has come this hand — although the member 61 is not illustrated — some circular wafers 3 — the shape of two forks which met the edge — carrying out — **** — the hand of the shape of this fork — a suction slot (not shown) forms in a member 61 — having — this suction slot — the part by the side of the rear face of a wafer 3 — an edge portion is attracted and a wafer 3 is fixed at the time of conveyance

[0025] moreover, the carrier robot 6 — the hand from the supporter material 41a and 41b of the substrate attachment component 4, after receiving a wafer 3 by the member 61 a hand — a member 61 and an arm — rotating a wafer 3 with a member 62, or it being made to move, or It is possible to convey the wafer [finishing / washing processing] 3 at the following process, or to hold the wafer / finishing / washing processing] 3 temporarily in the carrier (not shown) which can hold two or more wafers 3 etc. moreover — that a carrier robot 6 conveys a wafer 3 from a last process **** — the wafer 3 in a carrier (not shown) — a hand — after receiving by the member 61 — a hand — a member 61 and an arm — a wafer 3 is rotated with a

member 62, or it is possible to make it move, and the wafer 3 could be supplied on the substrate attachment component 4, and it has come

[0026] furthermore, mixing to which control means 7 were connected with the processing liquid feed hopper 24 -- the bulb for pure water flow control currently arranged in the middle of piping connected through the member 27 -- with a member 71 this mixing -- the bulb for the 1st medical fluid flow control currently arranged in the middle of piping for the medical fluids connected through the member 27 -- with a member 72 mixing -- the bulb for the 2nd medical fluid flow control currently arranged in the middle of another piping for medical fluids connected through the member 27 -- with a member 73 the bulb for effluent flow control currently arranged in the middle of piping connected with the overflow effluent mouth 25 -- with a member 74 the bulb for effluent flow control currently arranged in the middle of piping connected with the exhaust port 26 -- with members 75 and 76 these bulbs -- the bulb for exhaust air flow control currently arranged in the middle of piping which branched from the connection section of members 75 and 76 -- with a member 77 and the reduced pressure pump 78 the bulb for raw-gas supply-flow-rate adjustment currently arranged in the middle of piping connected with the raw-gas feed hopper 21 -- with a member 79 these bulbs -- member 71- it connecting with 77, 79 and the reduced pressure pump 78, each driving member 22 and 42, and each control terminal of a carrier robot 6, respectively, and by controlling these sequentially The processing liquid or the raw gas of the various kinds [wafer / 3] in the state where held the wafer 3 in the interior of the substrate processing tub 2, and it was sealed is supplied, or it has the control section 80 controlled an effluent or by exhausting to perform dryness processing to medical fluid processing and a rinsing processing pan one by one. In addition, it is things needless to say that you may be various medical fluid processings, such as nitride removal processing, resist ablation processing, oxide-film etching processing, and washing processing before diffusion, besides the light etching processing shown with this operation gestalt as medical fluid processing in a series of various above-mentioned substrate processings.

[0027] This control section 80 consists of a sequencer, a microcomputer, etc., and one by one, it succeeds in control of each part material, and succeeds in a series of substrate conveyance processing and various substrate processings automatically.

[0028] The above-mentioned composition explains the operation below. The ** type view showing the important section composition of a wafer feeding-and-discarding state [in / the substrate processor of drawing 1 / in drawing 2], the ** type view showing the important section composition of the wafer pressure-from-below state in front of a rapid effluent / in / the substrate processor of drawing 1 / in drawing 3], and drawing 4 are the ** type views showing the important section composition of the state at the time of the reduced pressure drying in the substrate processor of drawing 1 .

[0029] First, as shown in drawing 2 , moving **** of the wafer [finishing / washing

processing] 3 and the wafer 3 which should be washed is performed.

[0030] that is, the control section 80 -- driving member 22 -- above -- move control -- carrying out -- a tub -- a member 23 -- receiving -- a top cover 5 -- opening wide -- each driving member 42 -- above -- move control -- carrying out -- a wafer 3 -- a tub -- in the state where it came out from the member 23 to the upper part, move control of the wafer 3 is carried out so that it may become a horizontal position. It is drawing in, while moving a member 61 upward. then, the control section 80 -- a hand -- a member 61 and an arm -- a member 62 -- extension control -- carrying out -- a hand -- a member 61 is located under the wafer 3 -- making -- a hand -- the wafer 3 supported by each supporter material 41a and 41b -- a hand -- a member 61 top -- moving -- changing -- further -- a hand -- a member 61 and an arm -- a member 62 is performed for shortening control, rotation control, etc., for example, the wafer [finishing / washing processing] 3 is conveyed and held in the carrier for interim storage (not shown) etc.

[0031] It receives on a member 61. moreover, the wafer 3 out of another carrier (not shown) with which a control section 80 controls a carrier robot 6, and two or more wafers 3 for washing are held -- a hand -- Extension control of the member 62 is carried out. the hand -- the state where the wafer 3 which should be washed on a member 61 was laid -- a hand -- a member 61 and an arm -- a hand -- a wafer 3 is located above each supporter material 41a and 41b with a member 61 -- making -- a hand -- stopping suction, while moving a wafer 3 downward with a member 61 -- a wafer 3 -- a hand -- it moves from on a member 61 on each supporter material 41a and 41b, and changes

[0032] this time -- a control section 80 -- a bulb -- members 71 and 74 -- opening control -- carrying out -- a tub -- supplying so that pure water can be overflowed in a member 23 -- a tub -- the inside of a member 23 is filled with pure water in addition, other bulbs -- members 72, 73, 75, and 79 are made the stoppage state by the control section 80

[0033] Next, as shown in drawing 1, a wafer 3 is held in the interior in the state of being immersed, the substrate processing tub 2 is made into a sealing state, and pure water washing processing is performed to a medical fluid processing pan.

[0034] That is, a control section 80 is in the state which laid the wafer 3 on each supporter material 41a and 41b. each driving member 42 -- down -- move control -- carrying out -- a tub -- the seal member which carries out move control of the driving member 22 further down by locating a longitudinal direction with a predetermined inclination posture in the pure water in a member 23, and is not illustrated -- minding -- a tub -- the interior is made into a sealing state as it puts by the member 23 and the top cover 5 this time -- a tub -- the pure water in a member 23 is supplied from the processing liquid feed hopper 24, and the effluent is overflowed and carried out from the overflow effluent mouth 25 of the opposite side

[0035] Open control of the member 72 is carried out. this state -- the bulb for the

1st medical fluid flow control in a control section 80 -- the 1st medical fluid (for example, the case of light etching HF) -- mixing -- a member 27 -- mixing -- the tub from the processing liquid feed hopper 24 -- because are supplied in a member 23 where predetermined concentration is mixed with pure water, and this overflows a tub -- the inside of a member 23 is replaced by the 1st medical fluid of predetermined concentration, and it succeeds in medical fluid processing of a wafer 3 a predetermined time of after -- the bulb for the 1st medical fluid flow control in a control section 80 -- a member 72 -- stoppage control -- carrying out -- the pure water from the processing liquid feed hopper 24 -- a tub -- it being supplied in a member 23 and making it overflow -- it is -- a tub -- the inside of a member 23 is replaced by pure water, and it succeeds in pure water washing processing of a wafer 3 this time -- pure water -- a tub -- the medical fluid which adhered to the wafer 3 by making it overflow from a member 23 at the time of medical fluid processing, and the matter (particle) generated by medical fluid processing -- pure water -- a tub -- it begins to pass through the overflow effluent mouth 25 out of a member 23 After a predetermined time, each process of pure water washing processing is repeated the number of predetermined times to a medical fluid processing pan like the above, and medical fluid processing and pure water rinsing processing are ended.

[0036] Then, reduced-pressure-drying processing is performed through wafer pressure-from-below operation before a rapid effluent, and ejection of the wafer [finishing / washing processing] 3 is performed.

[0037] that is, the state which carried out move control of each driving member 42 of both above, and laid the wafer 3 with the inclination posture on each supporter material 41a and 41b in order that a control section 80 might suppress the load to the wafer 3 at the time of a rapid effluent -- it is -- a tub, although you make it located on the pure water oil level in a member 23 this time -- a bulb -- a member 79 carries out opening control -- having -- the inside of the substrate processing tub 2 of the raw-gas feed hopper 21 to a sealing state -- as [expose / into the atmosphere / the front face of a wafer 3 / the raw gas for dryness of hot nitrogen gas, an IPA (isopropyl alcohol) steam, etc. is supplied, and / for example,] and the control section 80 -- a bulb -- members 75 and 76 -- both -- opening control -- carrying out -- the tub from an exhaust port 26 -- the rapid effluent of pure water, a contamination, etc. in a member 23 is carried out this time -- a control section 80 -- other bulbs -- member 71- 74 and 77 are in the sealing state by which stoppage control was carried out, the inside of the substrate processing tub 2 is filled with the raw gas which consists of hot nitrogen gas and hot IPA (isopropyl alcohol) gas, and the moisture of the front face of a wafer 3 is exposed and replaced by IPA gas furthermore, the control section 80 -- a bulb -- a member 76 -- stoppage control -- carrying out -- a bulb -- while carrying out opening control of the member 77 -- the reduced pressure pump 78 -- driving -- the tub from an exhaust port 26 -- the rapid exhaust air of the gas atmosphere in a member 23 is carried out, and it succeeds in IPA dryness

processing by making the inside of the substrate processing tub 2 into a reduced pressure state this time -- a control section 80 -- a bulb -- stoppage control of the member 79 is carried out

[0038] furthermore, a predetermined time of after and a control section 80 -- a bulb -- while carrying out opening control of the member 79, carrying out an elevated-temperature nitrogen purge and returning the interior to atmospheric pressure -- a bulb -- the inside of the substrate processing tub 2 is made into a sealing state by carrying out stoppage control of the members 71-77 altogether In order to make it whether the front face of a wafer 3 is made, and not exposed into the atmosphere, you may make it make it stand by till the stage to convey the wafer [finishing / washing processing] 3 at the following process in this state.

[0039] Then, it will be taken out as the wafer [finishing / washing processing] 3 described above from the inside of the substrate processing tub 2, and the wafer 3 which should newly be washed will be set in the substrate processing tub 2.

[0040] as mentioned above, the top cover 5 in which opening or sealing of the interior is free and a tub -- with the substrate processing tub 2 which consists of a member 23 77, 79, driving member 22 and 42, and the reduced pressure pump 78 are controlled by the control section 80. this tub -- the substrate attaching part 4 which can hold a wafer 3 within a member 23, and a bulb -- member 71- a tub -- processing liquid or/, and a raw gas by supply or/, and discharging in a member 23 It has the control means 7 controlled to perform dryness processing to medical fluid processing and a rinsing processing pan one by one, and one wafer 3 is immersed into the processing liquid in the sealed small substrate processing tub 2, and various processings are performed to the front face.

[0041] For this reason, while the position dependency in a tub of the etch uniformity conventionally produced with the equipment for batch processing processed simultaneously two or more sheets is cancelable, generating of the watermark (silverfish) conventionally produced with the substrate processor for sheet processing can be suppressed, and the homogeneity on the front face of a substrate can be held, and it can respond to enlargement of substrate size without the injury by rotation. Moreover, since a wafer 3 is the small chamber which enters only one sheet in the substrate processing tub 2, while being able to attain miniaturization and ** space-ization, ***** liquefaction, and also medical fluid substitution and reduced pressure attainment can attain shortening of the processing time early, a throughput can improve and low-cost-ization can be attained. Thus, since it is a small tub (chamber), the miniaturization of equipment size is possible, and if two or more the small tubs (chamber) are prepared, improvement in the further throughput will also be attained.

[0042] Moreover, since the substrate attaching part 4 can move a wafer 3 to the lower position in processing liquid, and the upper position besides processing liquid freely in the state where it held in the longitudinal direction, a wafer 3 can be made to be able to flood with processing liquid in the lower position, predetermined processing

can be performed, and a wafer 3 can be delivered easily in an upper position. Moreover, since the wafer 3 as a substrate is held with the inclination posture at the time of this predetermined processing so that a processing liquid supply side may become low, When making the lateral wafer 3 immersed in processing liquid or taking it out from the inside of processing liquid, while being able to suppress the liquid remainder bending of a wafer 3 and on it and being able to make a liquid piece good The position dependency in a tub of the etch uniformity conventionally produced with the equipment for batch processing processed simultaneously two or more sheets can be more certainly canceled because the supplied processing liquid flows in abbreviation homogeneity on the whole front face of a wafer 3 reasonable.

[0043] Furthermore, if the nitrogen purge of the inside of the substrate processing tub 2 is carried out and various processings are performed, the problems that the front face was not exposed to the atmosphere and it originated in growth of a surface natural oxidation film like before and it during the period when the wafer 3 held in the substrate processing tub 2 is processed within the substrate processing tub 2 at least, such as generating of particle, will be solved, and homogeneous nearby maintenance of the substrate front face will be carried out. In addition, a wafer 3 cannot receive the environmental influence from contamination of for example, medical fluid scattering Myst or others easily because of a sealing chamber, either.

[0044] Furthermore, if a wafer 3 is supported to lengthwise (perpendicular posture), although the front face and rear face of a wafer 3 contact, the supporter material Since it is supporting with this operation gestalt so that a wafer 3 may be received from a lower part with an inclination posture, while the supporter material 41a and 41b does not contact the front face of a wafer 3 but the injury on contamination of the supporting section of the front face of a wafer 3, a blemish, etc. is suppressed sharply The portion which cannot be washed to the front-face side is also lost, there is no dryness remainder of the supporting section, and good dryness can be obtained. The surface portion of this wafer 3 is an important portion from which a semiconductor device etc. is made.

[0045] Furthermore, for single wafer processing processed for every sheet, it comes off from the front face of a wafer 3, and there is no generating of the particle by the so-called wafer imprint in which the particle which fell carries out the reattachment to the front face of another wafer 3.

[0046] In addition, although it constituted from this operation gestalt so that the processing liquid supplied in the tub might be made to overflow from the overflow effluent mouth 25 and might carry out an effluent from the processing liquid feed hopper 24 a tub, if it constitutes so that the effluent tub in which an effluent is possible may be prepared in response to the processing liquid overflowed from the depot around a depot and this depot in a member 23 In pure water washing processing etc., the medical fluid which adhered to the substrate at the time of medical fluid processing, and the matter (particle) generated by medical fluid

processing with pure water an effluent tub -- minding -- an outline -- a member -- while becoming possible to begin to pass smoothly outside and suppressing the bad influence to a substrate front face further, it is suppressed further, and growth of a natural oxidation film etc. is suppressed further and the contact to the atmosphere on the front face of a substrate can also aim at further homogeneous maintenance on the front face of a substrate

[0047] Moreover, although it was made to support with an inclination posture in response to a wafer 3 from a lower part by the supporter material 41a and 41b, you may make it support a wafer 3 into a horizontal position or a perpendicular posture with this operation gestalt. When supporting a wafer 3 into a perpendicular posture, compared with support by the horizontal position or inclination posture of a wafer 3, the supporter material will be supported so that the front face and rear face of a wafer 3 may contact, the portion which cannot be washed to the front-face side of the important wafer 3 with which a semiconductor device etc. is made may arise, or the injury on contamination of the supporting section of the front face, a blemish, etc. may produce it.

[0048]

[Effect of the Invention] the outline which was sealed as mentioned above according to the claim 1 -- a member, in order to make one substrate immersed into inner processing liquid and to perform various processings to a substrate front face While the position dependency in a tub of the etch uniformity conventionally produced with the equipment for batch processing is cancelable Generating of the watermark (silverfish) conventionally produced with the substrate processor for sheet processing can be suppressed, and the homogeneity on the front face of a substrate can be held, and it can be made to correspond to enlargement of substrate size without the injury by rotation. moreover, a substrate -- an outline -- a member -- since it is the small tub which enters only one sheet inside, while being able to attain miniaturization and ** space-ization -- ***** liquefaction -- further, shortening of the processing time can also be attained and low-cost-ization can be attained

[0049] moreover -- according to a claim 2 -- the effect of a claim 1 -- in addition, an outline -- a member, since the depot which can hold a substrate, and the effluent tub which receives the processing liquid overflowed from this depot are prepared with processing liquid inside The medical fluid which adhered to the substrate at the time of medical fluid processing, the matter (particle) generated by medical fluid processing for example, with pure water an effluent tub -- minding -- an outline -- a member, while being able to beginning to pass smoothly by outside and being able to suppress the bad influence to a substrate front face further The contact to the atmosphere on the front face of a substrate can be prevented more, growth of a natural oxidation film etc. can be suppressed further, and the further homogeneity on the front face of a substrate can be maintained.

[0050] furthermore -- according to a claim 3 -- the effect of claims 1 or 2 -- in

addition, since a substrate attaching part can move a substrate to the lower position in processing liquid, and the upper position besides processing liquid freely in the state where it held in the longitudinal direction, a substrate is made to flood with processing liquid in the lower position, predetermined processing is performed, and it can perform delivering a substrate easily in an upper position.

[0051] According to the claim 4, in the effect of claims 1-3 Furthermore, since [in addition,] it inclines and the substrate is supported for the processing liquid supply side so that it may become low, When making a lateral substrate immersed in processing liquid or taking out from the inside of processing liquid, while being able to suppress bending and the liquid remainder of a substrate and being able to make a liquid piece good The position dependency in a tub of the processing homogeneity conventionally produced with the equipment for batch processing can be more certainly canceled because the supplied processing liquid flows in the whole substrate front face reasonable.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the ** type view showing the outline composition of the substrate processor of 1 operation gestalt of this invention.

[Drawing 2] Drawing 2 is the ** type view showing the important section composition of the wafer feeding-and-discarding state in the substrate processor of drawing 1 .

[Drawing 3] It is the ** type view showing the important section composition of the wafer pressure-from-below state in front of the rapid effluent in the substrate processor of drawing 1 .

[Drawing 4] It is the ** type view showing the important section composition at the time of the reduced pressure drying in the substrate processor of drawing 1 .

[Description of Notations]

1 Substrate Processor

2 Substrate Processing Tub
3 Wafer
4 Substrate Attachment Component
5 Top Cover
6 Carrier Robot
7 Control Means
21 Raw-Gas Feed Hopper
22 42 Driving member
23 Tub -- Member
24 Processing Liquid Feed Hopper
25 Overflow Effluent Mouth
26 Exhaust Port
41a, 41b Supporter material
61 Hand -- Member
62 Arm -- Member
71- 77 and 79 a bulb -- member
78 Reduced Pressure Pump
80 Control Section

[Translation done.]

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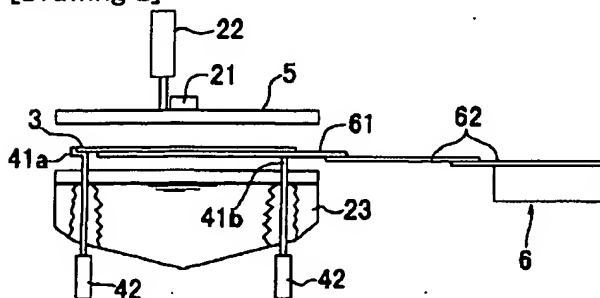
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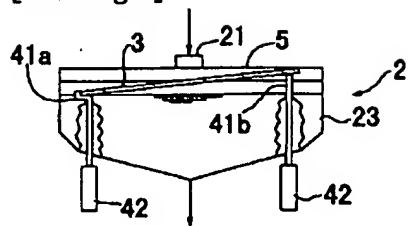
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DRAWINGS

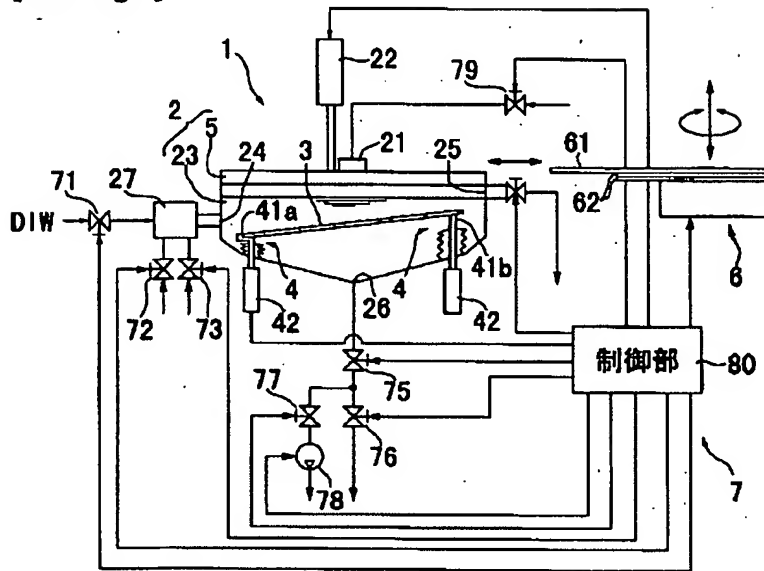
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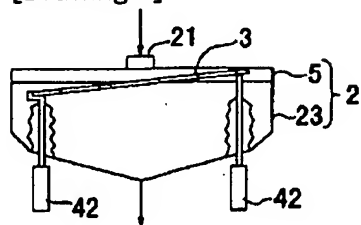
[Drawing 3]



[Drawing 1]



[Drawing 4]



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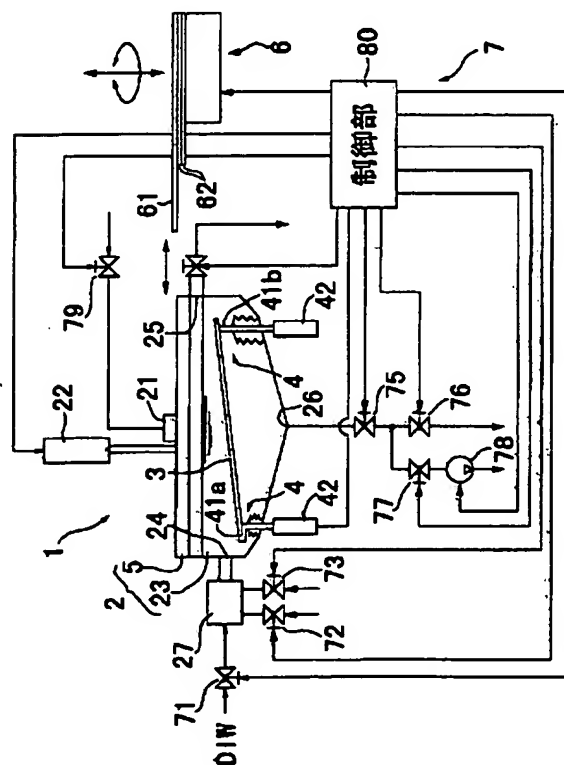
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(54) 【発明の名称】 基板処理装置

(57) 【要約】

【課題】 バッチ処理用の装置で従来生じていた処理均一性の槽内位置依存性を解消すると共に装置自体のサイズをコンパクト化し、また、枚葉処理用の基板処理装置で従来生じていたウオータマーク(シミ)の発生を抑えて基板表面の均一性を保持すると共に回転による損傷なく基板サイズ的大型化に対応させる。

【解決手段】 内部を開放または密閉自在な上蓋5および槽部材23よりなる基板処理槽2と、この槽部材23内でウエハ3を保持可能な基板保持部4と、バルブ部材71~77, 79、駆動部材22, 42および減圧ポンプ78を制御部80で制御して、槽部材23内に処理液または/および処理ガスを供給または/および排出することで、薬液処理、水洗処理さらに乾燥処理を順次行うように制御する制御手段7とを有し、密閉した小型の基板処理槽2内の処理液中に1枚のウエハ3を浸漬してその表面に各種処理を施すようになっている。



【特許請求の範囲】

【請求項1】 基板を内部に保持した状態で基板表面を処理可能な基板処理装置において、

内部を開放または密閉自在な外郭部材と、この外郭部材内で基板を保持可能な基板保持部と、前記外郭部材内に処理液または／および処理ガスを供給または／および排出するように制御する制御手段とを有することを特徴とする基板処理装置。

【請求項2】 基板を内部に保持した状態で基板表面を処理可能な基板処理装置において、

内部を開放または密閉自在な外郭部材と、この外郭部材内に配設され処理液を貯留可能な貯留槽と、この貯留槽内で基板を横方向に保持可能な基板保持部と、前記貯留槽からオーバーフローした処理液を受ける排液槽と、前記貯留槽内への処理液の供給、前記外郭部材内への処理ガスの供給、前記貯留槽内または／および排液槽内からの排液または排気を制御する制御手段とを有することを特徴とする基板処理装置。

【請求項3】 前記基板保持部は、前記基板を水平または傾斜姿勢で支持する支持部材と、この支持部材を処理液内と処理液外の上下位置に移動させる駆動部材とを有したことを特徴とする請求項1または2に記載の基板処理装置。

【請求項4】 前記支持部材は、処理液供給側が低くなるように基板を傾斜させて支持可能な構成としたことを特徴とする請求項3の何れかに記載の基板処理装置。

【発明の詳細な説明】**【0001】**

【発明の属する技術分野】本発明は、半導体ウエハや液晶表示パネル用ガラス基板などの薄板状の被処理基板（以下単に基板という）に処理液や処理ガスを供給して基板に所定の表面処理を施す基板処理装置に関する。

【0002】

【従来の技術】従来より、半導体装置や液晶表示装置を製造するための装置の一つとして、半導体ウエハや液晶表示装置用ガラス基板などの基板上に薄膜を形成したり、基板を洗浄エッチングしたりする基板処理装置が提供されている。この基板処理装置では、薄膜を形成する処理部や基板洗浄を行う処理部などが設けられており、基板搬送装置によって被処理基板をこれらの処理部の間で搬送しながら、各処理部で基板に処理液を供給して基板の表面処理を行っている。

【0003】例えば、バッチ処理用の多槽式の基板処理装置の場合、基板を複数枚同時に基板搬送装置で搬送して、複数の処理槽において順次、処理液内に浸漬させることで、薬液処理さらに純水洗浄処理を行い、最後にスピンドライヤやIPAベードライヤなどで乾燥処理を行っている。

【0004】また、バッチ処理用の単槽式の基板処理装

置の場合、基板を複数枚同時に基板搬送装置で搬送して処理液内に浸漬させることで、薬液処理さらに純水洗浄処理を一つの槽で順次行っている。

【0005】一方、枚葉処理用の基板処理装置の場合、基板搬送装置で基板を一枚づつ搬送して、例えばスプレーおよび回転処理でエッチングや、洗浄処理を行い、その後、回転振り切りしたり、エアナイフによって乾燥処理を行っている。

【0006】

【発明が解決しようとする課題】ところが、上記従来のバッチ処理用の多槽式および単槽式の基板処理装置では、基板面が互いに対向するように配列した複数の基板を、オーバーフローしている処理液内に浸漬させて例えばエッチングや洗浄処理などを行う場合、中間に位置している基板と、手前側あるいは奥側など両端に位置している基板とでは処理液の流れが異なるので、例えばエッチングや洗浄処理などにおいてバラツキが生じ、処理均一性の槽内位置依存性が発生するという問題を有していた。この均一性の槽内位置依存性は、例えば口径300mmといったように基板としてのウエハが大口径になるほど顕著に現われる。また、複数の基板を同時に処理するため、バッチ処理用の基板処理装置では、その槽のサイズと共に装置自体のサイズも大きくなって、薬液や純水などの多量の処理液が必要になるという問題を有していた。さらに、この場合、減圧乾燥に関しても大きな槽が別に必要になってくる。

【0007】また、上記従来の枚葉処理用の基板処理装置では、1枚づつ基板を搬送して例えばスプレー回転洗浄処理などを行うため、基板の各種処理中において基板の表面が水分と共に大気に晒されると、表面自然酸化膜の成長などに起因したウオータマーク（シミ）の発生、さらに、それによるパーティクルの発生など基板表面の均一性が損なわれるという問題を有していた。この自然酸化膜は抵抗値が不安定であって、例えば半導体装置などの製造における歩留まりを低下させる要因になっている。また、枚葉処理用の基板処理装置では、1枚づつ基板を回転させて各種処理を行うため、ウエハの口径など基板サイズが大きくなるほど、回転による基板自体やメカ部の負荷が大きくなって、それらの損傷防止の観点から基板サイズが大きくできないという問題を有していた。

【0008】本発明は、上記従来の問題を解決するもので、バッチ処理用の装置で従来生じていたエッチング均一性の槽内位置依存性を解消すると共に装置自体のサイズをコンパクト化し、また、枚葉処理用の基板処理装置で従来生じていたウオータマーク（シミ）の発生を抑えて基板表面の均一性を保持すると共に回転による損傷なく基板サイズの大型化に対応させることができる基板処理装置を提供することを目的とする。

【0009】

【課題を解決するための手段】本発明の基板処理装置は、基板を内部に保持した状態で基板表面を処理可能な基板処理装置において、内部を開放または密閉自在な外郭部材と、この外郭部材内に基板を保持可能な基板保持部と、外郭部材内に処理液または／および処理ガスを供給または／および排出するように制御する制御手段とを有することを特徴とするものである。

【0010】この構成により、密閉した外郭部材内において処理液中に1枚の基板を浸漬させた状態で基板表面に各種処理を施すので、バッチ処理用の装置で従来生じていた処理の均一性の槽内位置依存性が解消されると共に、枚葉処理用の基板処理装置で従来生じていたウオータマーク（シミ）の発生が抑えられて基板表面の均一性が保持され、かつ、従来のような回転による損傷なく基板サイズの大型化に対応させることが可能となる。また、外郭部材は基板が1枚入るだけの小型なものであるため、コンパクト化や省スペース化を図ると共に省処理液化、さらには、処理時間の短縮化も図ることが可能となつて、低コスト化が図られる。

【0011】また、本発明の基板処理装置は、基板を内部に保持した状態で基板表面を処理可能な基板処理装置において、内部を開放または密閉自在な外郭部材と、この外郭部材内に配設され処理液を貯留可能な貯留槽と、この貯留槽内で基板を横方向に保持可能な基板保持部と、貯留槽からオーバーフローした処理液を受ける排液槽と、貯留槽内への処理液の供給、外郭部材内への処理ガスの供給、貯留槽内または／および排液槽内からの排液または排気を制御する制御手段とを有することを特徴とするものである。

【0012】この構成により、上記作用に加えて、外郭部材内には、処理液を貯留すると共に基板を収容する貯留槽と、この貯留槽からオーバーフローした処理液を受ける排液槽とが設けられているので、例えば純水洗浄処理などの場合に、薬液処理時に基板に付着した薬液、および薬液処理により発生した物質（パーティクル）を純水と共に、排液槽を介して外郭部材外にスムーズに流し出すことが可能となつて、基板表面に対する悪影響をさらに抑制すると共に、基板表面の大気への接触もさらに抑制されて自然酸化膜の成長などがさらに抑制され、基板表面の更なる均一性の維持が可能となる。

【0013】さらに、好ましくは、本発明の基板処理装置における基板保持部は、基板を水平または傾斜姿勢で支持する支持部材と、この支持部材を処理液内と処理液外の上下位置に移動させる駆動部材とを有したことを特徴とする。

【0014】この構成により、基板保持部は、基板を支持部材で横方向に保持した状態で処理液内の下位置と処理液外の上位置に駆動部材によって移動自在であるので、その下位置で基板を処理液に浸漬させて所定の処理を行い、上位置で基板の受液しが容易に為される。

【0015】さらに、好ましくは、本発明の基板処理装置における支持部材は、処理液供給側が低くなるように基板を傾斜させて支持可能な構成としたことを特徴とする。

【0016】この構成により、処理液供給側が低くなるように基板が横方向に傾斜して支持されているので、横方向の基板を処理液内に浸漬させたり処理液内から出したりするが、このときに、基板の撓みや基板表面上の液残りを抑制して液切れを良好なものとすると共に、供給された処理液が基板表面全体に当たって流れ易くすることで、バッチ処理用の装置で従来生じていた処理均一性の槽内位置依存性はより確実に解消され得る。

【0017】

【発明の実施の形態】以下、本発明に係る基板処理装置の実施形態について図面を参照して説明するが、本発明は以下に示す実施形態に限定されるものではない。

【0018】図1は本発明の一実施形態の基板処理装置の概略構成を示す模式図である。

【0019】図1において、基板処理装置1は、内部を開放または密閉自在な外郭部材としての基板処理槽2と、この基板処理槽2内で基板としてのウエハ3を保持すると共に、ウエハ3を保持した状態でウエハ3を上下移動可能な基板保持部材4と、この基板処理槽2の上蓋5の開口時に基板処理槽2に対してウエハ3を給排する搬送ロボット6と、これらの基板保持部材4および搬送ロボット6を制御してウエハ3を移動させると共に、基板処理槽2内に処理液または／および処理ガスを供給または／および排出してウエハ3を内部に収容した密閉状態でウエハ3の表面に各種の薬液処理、水洗処理さらに乾燥処理を順次行うように制御する制御手段7とを有している。

【0020】この基板処理槽2は、窒素ガスやIPA（イソプロピルアルコール）蒸気を供給自在な処理ガス供給口21と、この処理ガス供給口21が中央部に配設された上蓋5と、この上蓋5の外壁適所に先端部が取り付けられ、上蓋5を上下移動させる開閉用のソレノイドやシリンダなどの駆動部材22と、この駆動部材22で上蓋5を上下移動させることで、その内部が開放自在であるとと共に、図示しないシール材を上蓋5とで挟み込んで密閉自在な槽部材23と、この槽部材23の側壁下部に配設され、槽内に薬液や純水などの処理液を供給する処理液供給口24と、この処理液供給口24が配設された槽部材23の側壁とは反対側の側壁上部に配設され、処理液供給口24から槽内に供給された処理液をオーバーフローさせて排液するオーバーフロー排液口25と、槽部材23の底壁中央部に配設されており、槽部材23内の処理液を急速排液するかまたは、槽部材23内の気体を排気して減圧する排出口26とを有している。このように、基板処理槽2は、基板としてのウエハ3が横方向に1枚収容可能なディップ式の小型の密閉チャンバで

あり、装置サイズの小型化と共に、薬液置換が早く、減圧到達も早くできてスループットを向上させることができるようになっていく。

【0021】また、基板保持部材4は、処理液供給口24側が低くなり、オーバーフロー排液口25側が高くなるようにウエハ3を横方向に傾斜させた状態で複数支持（本実施形態では2箇所支持）でウエハ3の裏面の端縁部分を下方から受けると共にウエハ2の端部を支持する支持部材41a、41bと、これらの支持部材41a、41bにそれぞれ各先端部がそれぞれ取り付けられており、これらの支持部材41a、41bをそれぞれ、処理液内の下位置と処理液上の上位置の間でそれぞれ上下移動させるシリンダなどの各駆動部材42とを有している。この支持部材41aはウエハ3の一部下側の端縁部分に沿って線接触で支持し、支持部材41bは上側の端縁部分を点接触で支持しており、ウエハ3の表面側に洗浄しきれないような部分が発生しないように、これら支持部材41a、41bはウエハ3の裏面端縁接触だけで構成している。

【0022】また、このように、1枚のウエハ3を横方向に傾斜させて保持しているのは、処理液の流れに沿ってウエハ3の表面が向くように保持しており、処理液供給口24から供給される処理液を、ウエハ2の表面側全体で受けて、オーバーフロー排液口25からスムーズにオーバーフローさせて排液することで、従来の複数枚ディップ式のようなエッチング均一性の槽内位置依存性が発生しないようにしていると共に、処理液上の上位置にウエハ3を移動させる場合に、ウエハ3にできるだけ負荷がかからずウエハ3が撓んで処理液が溜ったりしないように液切れのよい構成となっている。この場合のウエハ2の傾斜角度は、ウエハ2などの基板が撓むことなく、ウエハ3の表面の処理液が容易にウエハ3の表面から流れ落ちる程度の液切れのよい角度を選定する必要があるが、貯留させる処理液量との関係で槽部材23は浅い方がよい。

【0023】また、槽部材23の底壁部分の基板保持部材4の配設位置には、フッ素樹脂などの弾性体よりなる蛇腹状部材が槽部材23内を密閉状態になるように蛇腹状部材の中央部分が上下移動自在に配設されており、両駆動部材42によって支持部材41a、41bと共にウエハ3を傾斜姿勢で処理液内の下位置と処理液上の上位置の間をそれぞれ上下移動自在に構成している。本実施形態では、ウエハ3の給排時には、この処理液上の上位置からさらにウエハ3を水平姿勢とし、搬送ロボット6による受渡しが容易なように構成しているが、処理液上の上位置のウエハ3の傾斜姿勢のままで、搬送ロボット6による受渡しを行うようにすることもできるのは言うまでもないことである。

【0024】さらに、搬送ロボット6は、ウエハ3を下方から支持するハンド部材61と、このハンド部材61

の先端部とは反対側の一端部に連結され、基板保持部材4によって上位置で保持されたウエハ3の下側までハンド部材61を伸ばしたり、基板保持部材4によって上位置で保持されたウエハ3の下側から図1の所定位置まで縮めたりするアーム部材62とを有しており、これらのハンド部材61およびアーム部材62を共に上方向に移動させることで、基板保持部材4で保持されたウエハ3をハンド部材61上に載置して持ち上げることで基板保持部材4からウエハ3を受取可能で、また、ハンド部材61上にウエハ3を載置した状態でハンド部材61およびアーム部材62をウエハ3と共に下方向に移動させることで、基板保持部材4上にウエハ3を載置させて基板保持部材4上にウエハ3を供給可能なようになっている。このハンド部材61は、図示していないが、円形のウエハ3の一部端縁に沿った2本のフォーク状をしており、このフォーク状のハンド部材61には吸引溝（図示せず）が形成され、この吸引溝でウエハ3の裏面側の一部端縁部分を吸引して搬送時にウエハ3を固定化するようになっている。

【0025】また、搬送ロボット6は、基板保持部材4の支持部材41a、41bからハンド部材61でウエハ3を受取った後に、ハンド部材61およびアーム部材62と共にウエハ3を回動させたり移動させたり、洗浄処理済みのウエハ3を次工程に搬送したり、複数枚のウエハ3が収容可能なキャリア（図示せず）内などに洗浄処理済みのウエハ3を一時的に収容したりすることが可能になっている。また、搬送ロボット6は、ウエハ3を前工程から搬送したり、キャリア（図示せず）内のウエハ3をハンド部材61で受取ったりした後に、ハンド部材61およびアーム部材62と共にウエハ3を回動させたり移動させたりすることが可能で、基板保持部材4上にウエハ3を供給可能なようになっている。

【0026】さらに、制御手段7は、処理液供給口24に連結されたミキシング部材27を介して連結された配管途中に配設されている純水流量調整用のバルブ部材71と、このミキシング部材27を介して連結された薬液用の配管途中に配設されている第1薬液流量調整用のバルブ部材72と、ミキシング部材27を介して連結された別の薬液用の配管途中に配設されている第2薬液流量調整用のバルブ部材73と、オーバーフロー排液口25に連結された配管途中に配設されている排液流量調整用のバルブ部材74と、排出口26に連結された配管途中に配設されている排液流量調整用のバルブ部材75、76と、これらのバルブ部材75、76の連結部から分岐された配管途中に配設されている排気流量調整用のバルブ部材77および減圧ポンプ78と、処理ガス供給口21に連結された配管途中に配設されている処理ガス供給流量調整用のバルブ部材79と、これらのバルブ部材71～77、79および減圧ポンプ78、各駆動部材22、42、搬送ロボット6の各制御端子にそれぞれ接続

され、これらを順次制御することで、ウエハ3を基板処理槽2の内部に収容して密閉した状態でウエハ3に各種の処理液または処理ガスを供給したり排液または排気することによって、薬液処理、水洗処理さらに乾燥処理を順次行うように制御する制御部80とを有している。なお、上記一連の各種基板処理における薬液処理として、本実施形態で示したライトエッチング処理の他に、窒化膜除去処理、レジスト剥離処理、酸化膜エッチング処理および拡散前洗浄処理などの各種薬液処理であってもよいことは言うまでもないことである。

【0027】この制御部80は、シーケンサやマイクロコンピュータなどで構成されており、順次、各部材の制御が為されて一連の基板搬送処理や各種基板処理が自動的に為されるようになっていいる。

【0028】上記構成により、以下にその動作を説明する。図2は図1の基板処理装置におけるウエハ給排状態の要部構成を示す模式図、図3は図1の基板処理装置における急速排液前のウエハ突上状態の要部構成を示す模式図、図4は図1の基板処理装置における減圧乾燥時の状態の要部構成を示す模式図である。

【0029】まず、図2に示すように、洗浄処理済みのウエハ3と洗浄すべきウエハ3の移し換えを行う。

【0030】つまり、制御部80は、駆動部材22を上方向に移動制御して、槽部材23に対して上蓋5を開放し、各駆動部材42を上方向に移動制御して、ウエハ3が槽部材23から上方に出た状態でウエハ3を水平姿勢になるように移動制御する。その後、制御部80は、ハンド部材61およびアーム部材62を伸長制御して、ハンド部材61をそのウエハ3の下方に位置させ、ハンド部材61を上方向に移動させると共に吸引することで、各支持部材41a、41bで支持されたウエハ3をハンド部材61上に移し換え、さらに、ハンド部材61およびアーム部材62を短縮制御、回転制御などを行って例えば一時保管用のキャリア（図示せず）内などに洗浄処理済みのウエハ3を搬送して収容する。

【0031】また、制御部80は搬送ロボット6を制御して、洗浄用のウエハ3が複数収容されている別のキャリア（図示せず）内からウエハ3をハンド部材61上に受けとって、そのハンド部材61上に洗浄すべきウエハ3を載置した状態で、ハンド部材61およびアーム部材62を伸長制御して、ハンド部材61と共にウエハ3を各支持部材41a、41bの上方に位置させ、ハンド部材61と共にウエハ3を下方方向に移動させると共に吸引を停止することで、ウエハ3をハンド部材61上から各支持部材41a、41b上に移し換える。

【0032】このとき、制御部80は、バルブ部材71、74を開口制御して槽部材23内に純水をオーバーフロー可能なように供給することで槽部材23内は純水で満たされている。なお、他のバルブ部材72、73、75、79は制御部80によって閉止状態とされてい

る。

【0033】次に、図1に示すように、ウエハ3を内部に浸漬状態で収容して基板処理槽2を密閉状態とし薬液処理さらに純水洗浄処理を行う。

【0034】つまり、制御部80は、ウエハ3を各支持部材41a、41b上に載置した状態で、各駆動部材42を下方方向に移動制御して、槽部材23内の純水中に横方向に所定の傾斜姿勢で位置させ、さらに、駆動部材22を下方方向に移動制御して、図示しないシール部材を介して槽部材23と上蓋5とで挟み込むようにして内部を密閉状態とする。このとき、槽部材23内の純水は処理液供給口24から供給されその反対側のオーバーフロー排液口25からオーバーフローして排液されている。

【0035】この状態で、制御部80は第1薬液流量調整用のバルブ部材72を開放制御して、第1薬液（例えばライトエッチングの場合にはHF）をミキシング部材27を介して処理液供給口24から槽部材23内に純水と所定濃度に混合された状態で供給されこれがオーバーフローすることで、槽部材23内を所定濃度の第1薬液に置換してウエハ3の薬液処理が為される。所定時間後に、制御部80は第1薬液流量調整用のバルブ部材72を閉止制御して、処理液供給口24からは純水だけが槽部材23内に供給されオーバーフローするようにすることで、槽部材23内を純水に置換してウエハ3の純水洗浄処理が為される。このとき、純水を槽部材23からオーバーフローさせることで、薬液処理時にウエハ3に付着した薬液、および薬液処理により発生した物質（パーティクル）を純水と共に、槽部材23外にオーバーフロー排液口25を介して流し出す。所定時間後に、上記と同様に薬液処理さらに純水洗浄処理の各工程を所定回数繰り返して薬液処理および純水水洗処理を終了する。

【0036】その後、急速排液前のウエハ突上動作を経て減圧乾燥処理を行って、洗浄処理済みのウエハ3の取り出しを行う。

【0037】つまり、制御部80は、急速排液時のウエハ3への負荷を抑制するために、各駆動部材42と共に上方向に移動制御して、ウエハ3を各支持部材41a、41b上に傾斜姿勢で載置した状態で、槽部材23内の純水液面上に位置させるが、このとき、バルブ部材79が開口制御されて処理ガス供給口21から密閉状態の基板処理槽2内に例えば高温の窒素ガスやIPA（イソプロピルアルコール）蒸気などの乾燥用の処理ガスが供給されて、ウエハ3の表面が大気中に晒されるようなことはない。それから、制御部80は、バルブ部材75、76と共に開口制御して、排出口26から槽部材23内の純水および汚染物などを急速排液する。このとき、制御部80によって、その他のバルブ部材71～74、77は閉止制御された密閉状態であり、その基板処理槽2内は高温の窒素ガスやIPA（イソプロピルアルコール）ガスよりなる処理ガスで充滿されており、ウエハ3の表

面の水分はIPAガスに晒されて置換される。さらに、制御部80は、バルブ部材76を閉止制御してバルブ部材77を開口制御すると共に、減圧ポンプ78を駆動して排出口26から槽部材23内の気体雰囲気気を急速排気して基板処理槽2内を減圧状態としてIPA乾燥処理が為される。このとき、制御部80によってバルブ部材79は閉止制御されている。

【0038】さらに、所定時間後、制御部80は、バルブ部材79を開口制御して高温窒素パージして内部を大気圧に復帰させると共に、バルブ部材71~77を全て閉止制御することで基板処理槽2内を密閉状態とする。ウエハ3の表面ができるかぎり大気中に晒されないようにするために、この状態で洗浄処理済みのウエハ3を次工程に搬送する時期まで待機させるようにしてもよい。

【0039】その後、基板処理槽2内から洗浄処理済みのウエハ3が上記したように取り出されて、新たに洗浄すべきウエハ3が基板処理槽2内にセットされることになる。

【0040】以上のように、内部を開放または密閉自在な上蓋5および槽部材23よりなる基板処理槽2と、この槽部材23内でウエハ3を保持可能な基板保持部4と、バルブ部材71~77、79、駆動部材22、42および減圧ポンプ78を制御部80で制御して、槽部材23内に処理液または／および処理ガスを供給または／および排出することで、薬液処理、水洗処理さらに乾燥処理を順次行うように制御する制御手段7とを有し、密閉した小型の基板処理槽2内の処理液中に1枚のウエハ3を浸漬してその表面に各種処理を施すようになっている。

【0041】このため、複数枚同時に処理するバッチ処理用の装置で従来生じていたエッチング均一性の槽内位置依存性を解消することができると共に、枚葉処理用の基板処理装置で従来生じていたウオータマーク（シミ）の発生を抑えて基板表面の均一性を保持でき、かつ、回転による損傷なく基板サイズの大形化に対応することができる。また、ウエハ3が基板処理槽2内に1枚入るだけの小型チャンバであるため、コンパクト化や省スペース化を図ることができると共に省処理液化、さらには、薬液置換や減圧到達が早く、処理時間の短縮化を図ることができてスループットが向上し、低コスト化を図ることができる。このように、小型の槽（チャンバ）であるため、装置サイズの小型化が可能で、その小型の槽（チャンバ）を複数設ければ、さらなるスループットの向上も可能となる。

【0042】また、基板保持部4は、ウエハ3を横方向に保持した状態で処理液内の下位置と処理液外の上位置に移動自在であるため、その下位置でウエハ3を処理液に浸漬させて所定の処理を行い、上位置でウエハ3の受渡しを容易に行うことができる。また、この所定の処理時には、基板としてのウエハ3は処理液供給側が低くな

るように傾斜姿勢で保持されているため、横方向のウエハ3を処理液内に浸漬させたり処理液内から出したりするときに、ウエハ3の撓みやその上の液残りを抑制して液切れを良好なものとすることができると共に、供給された処理液が無理なくウエハ3の表面全体に略均一に当たって流れることで、複数枚同時に処理するバッチ処理用の装置で従来生じていたエッチング均一性の槽内位置依存性をより確実に解消することができる。

【0043】さらに、基板処理槽2内を窒素パージして各種処理を行えば、基板処理槽2内に収容されたウエハ3は、少なくとも基板処理槽2内で処理される期間中は、その表面が大気に晒されることはなく、従来のような表面自然酸化膜の成長や、それに起因したパーティクルの発生などの問題は解消され、基板表面の均一性もより維持される。この他、密閉チャンバのため、ウエハ3は、例えば薬液飛散ミストやその他の汚染からの環境の影響も受けにくいことになる。

【0044】さらに、ウエハ3を縦方向（垂直姿勢）に支持するのであれば、その支持部材はウエハ3の表面および裏面共に接触するが、本実施形態では、ウエハ3を傾斜姿勢で下方から受けるように支持しているため、その支持部材41a、41bはウエハ3の表面には接触せず、ウエハ3の表面の支持部分の汚染や傷などの損傷が大幅に抑制されると共に、その表面側に洗浄しきれない部分もなくなって、その支持部分の乾燥残りがなく良好な乾燥状態を得ることができる。このウエハ3の表面部分は、半導体装置などが作り込まれる重要な部分である。

【0045】さらに、1枚毎に処理する枚葉式のため、ウエハ3の表面から剥げ落ちたパーティクルが別のウエハ3の表面に再付着する所謂ウエハ転写によるパーティクルの発生がない。

【0046】なお、本実施形態では、処理液供給口24から槽内に供給された処理液をオーバーフロー排液口25からオーバーフローさせて排液するように構成したが、槽部材23内に貯留槽と、この貯留槽の周りに貯留槽からオーバーフローした処理液を受けて排液可能な排液槽とを設けるよう構成すると、純水洗浄処理などの場合に、薬液処理時に基板に付着した薬液、および薬液処理により発生した物質（パーティクル）を純水と共に、排液槽を介して外郭部材外にスムーズに流し出すことが可能となって、基板表面に対する悪影響をさらに抑制すると共に、基板表面の大気への接触もさらに抑制されて自然酸化膜の成長などがさらに抑制され、基板表面の更なる均一性の維持を図ることができる。

【0047】また、本実施形態では、支持部材41a、41bによってウエハ3を下方から受けて傾斜姿勢で支持するようにしたが、ウエハ3を水平姿勢または垂直姿勢に支持するようにしてもよい。ウエハ3を垂直姿勢に支持する場合には、ウエハ3の水平姿勢または傾斜姿勢

による支持に比べて、その支持部材はウエハ3の表面および裏面共に接触するように支持することによって、半導体装置などが作り込まれる重要なウエハ3の表面側に洗浄しきれない部分が生じたり、その表面の支持部分の汚染や傷などの損傷が生じたりする場合がある。

【0048】

【発明の効果】以上のように請求項1によれば、密閉した外郭部材内の処理液中に1枚の基板を浸漬させて基板表面に各種処理を施すようにしたため、バッチ処理用の装置で従来生じていたエッチング均一性の槽内位置依存性を解消できると共に、枚葉処理用の基板処理装置で従来生じていたウオータマーク（シミ）の発生を抑えて基板表面の均一性を保持でき、かつ、回転による損傷なく基板サイズの大形化に対応させることができる。また、基板が外郭部材内に1枚入るだけの小型槽であるため、コンパクト化や省スペース化を図ることができると共に省処理液化、さらには、処理時間の短縮化も図ることができて、低コスト化を図ることができる。

【0049】また、請求項2によれば、請求項1の効果に加えて、外郭部材内に、処理液と共に基板を収容可能な貯留槽と、この貯留槽からオーバーフローした処理液を受ける排水槽を設けているため、例えば薬液処理時に基板に付着した薬液、および薬液処理により発生した物質（パーティクル）などを純水と共に、排水槽を介して外郭部材外によりスムーズに流し出すことができ、基板表面に対する悪影響をさらに抑制することができると共に、基板表面の大気への接触をより防止することができて自然酸化膜の成長などをさらに抑制でき、基板表面の更なる均一性を維持することができる。

【0050】さらに、請求項3によれば、請求項1または2の効果に加えて、基板保持部は、基板を横方向に保持した状態で処理液内の下位置と処理液外の上位置に移動自在であるため、その下位置で基板を処理液に浸漬させて所定の処理を行い、上位置で基板の受渡しを容易に行うことができる。

【0051】さらに、請求項4によれば、請求項1～3の効果に加えて、基板が処理液供給側が低くなるように

傾斜して支持されているため、横方向の基板を処理液内に浸漬させたり処理液内から出したりするときに、基板の撓みや液残りを抑制して液切れを良好なものとすることができると共に、供給された処理液が無理なく基板表面全体に当たって流れることで、バッチ処理用の装置で従来生じていた処理均一性の槽内位置依存性をより確実に解消することができる。

【図面の簡単な説明】

【図1】本発明の一実施形態の基板処理装置の概略構成を示す模式図である。

【図2】図2は図1の基板処理装置におけるウエハ給排状態の要部構成を示す模式図である。

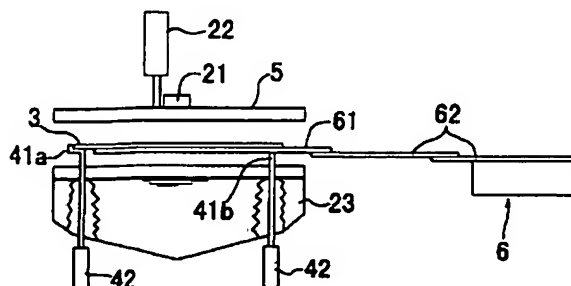
【図3】図1の基板処理装置における急速排水前のウエハ突上状態の要部構成を示す模式図である。

【図4】図1の基板処理装置における減圧乾燥時の要部構成を示す模式図である。

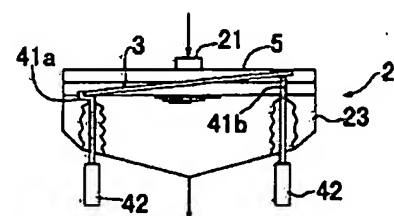
【符号の説明】

- 1 基板処理装置
- 2 基板処理槽
- 3 ウエハ
- 4 基板保持部材
- 5 上蓋
- 6 搬送ロボット
- 7 制御手段
- 21 処理ガス供給口
- 22, 42 駆動部材
- 23 槽部材
- 24 処理液供給口
- 25 オーバーフロー排水口
- 26 排出口
- 41a, 41b 支持部材
- 61 ハンド部材
- 62 アーム部材
- 71～77, 79 バルブ部材
- 78 減圧ポンプ
- 80 制御部

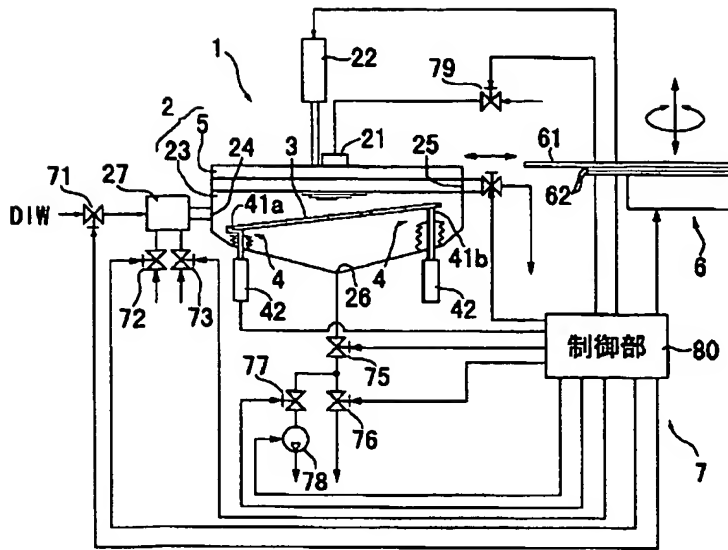
【図2】



【図3】



【図1】



【図4】

